

# Discovery of the subfamily Microleptinae (Hymenoptera, Ichneumonidae) from India and Thailand with the description of five new species

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## Abstract

The ichneumonid subfamily Microleptinae is reported from India and Thailand for the first time. We describe four new species from India (*Microleptes chiani* Ranjith & Humala, **sp. nov.**, *M. gowrishankari* Ranjith & Humala, **sp. nov.**, *M. sandeshkaduri* Ranjith & Humala, **sp. nov.**, *M. tehriensis* Ranjith & Humala, **sp. nov.**) and one new species from Thailand (*M. depressus* Ranjith & Humala, **sp. nov.**), and for the first time, we report the Chinese species, *M. xinbinensis* Sheng & Sun, from India and describe the hitherto unknown female. An identification key to the extant species of *Microleptes* is provided.

## Keywords

India, key, *Microleptes*, New distribution, Oriental region, taxonomy, Thailand

## Introduction

Microleptinae is one of the smallest subfamilies of Ichneumonidae, having a single genus *Microleptes* Gravenhorst, 1829 with 14 known species (Yu et al. 2016). The subfamily is distributed in the Palearctic, Nearctic and Oriental regions with

most species reported from the Palaearctic region (Yu et al. 2016). Only one species, *Microleptes malaisei* Kasparyan, 1998, is known from the Oriental region (Kasparyan 1998). Henry Townes—one of the leading ichneumonid systematists of 20<sup>th</sup> century, whose classification of ichneumonids was widely recognized—placed several genera with unclear systematic position in the subfamily Microleptinae and called it a “waste-basket” (Townes 1971). These primarily included the genera *Microleptes*, *Hyperacmus* Holmgren, 1858, *Cylloceria* Schiødte, 1838, *Tatogaster* Townes, 1971 and *Oxytorus* Förster, 1969, which were subsequently excluded therefrom. In a revision of the family-group names in Ichneumonidae by Fitton and Gauld (1976) the valid name Oxytorinae Thomson, 1883 with the type genus *Oxytorus* was adopted for Microleptinae *sensu* Townes according to the International Code of Zoological Nomenclature. Its classification has undergone major changes as a result of the study of head capsules in larvae of some representatives of the subfamily by D. Wahl. He excluded the genus *Microleptes* from subfamily Oxytorinae and placed it in a separate monotypic subfamily Microleptinae, though its position relative to the other ichneumonid subfamilies remained unclear for a long time (Wahl 1986, 1990; Wahl and Gauld 1998). He also proposed to separate two more genera *Cylloceria* and *Allomacrus* Förster, 1969 from this group into independent subfamily Cylloceriinae and *Tatogaster* into Tatogasterinae; while the other genera, except for *Oxytorus*, assigned to a separate subfamily, should be merged with orthocentrines in an expanded Orthocentrinae (Wahl 1990), where they are currently considered (Yu et al. 2016).

Quicke et al. (2009) commented on the contradicting phylogenetic position of the subfamily Microleptinae within Darwin wasps based on 28S rRNA (within or related to Ichneumoniformes), morphological (within Ophioniformes) and combined analysis (within Ophioniformes). Based on some superficial similarities in appearance, the genus *Hyperacmus* Holmgren, 1858 was included in the subfamily Microleptinae (Dasch 1992; Humala 2003), but later *Hyperacmus* was excluded from Microleptinae and transferred to the Cylloceriinae (Broad 2004; Humala 2007; Quicke et al. 2009).

Even though some species of *Microleptes* have been reared from stratiomyids (Wahl 1986; Schwarz 1991) the genus does not share any larval synapomorphies with the groups having a similar biology (parasitoids of Diptera) (Wahl 1986). Broad et al. (2018) assigned Microleptinae to unplaced subfamilies, although it was suggested that this group possibly related to the Ichneumoniformes. Santos (2017) included Microleptinae among ichneumoniformes groups of subfamilies and Bennett et al. (2019) supported this view and placed Microleptinae at the base of Ichneumoniformes s.l.

Species of *Microleptes* can be recognized by a combination of characters: antennal sockets protruding anteriorly, head ventrally with angular corners, mandible with blunt teeth, often fused, inner side of hind tibia with a fringe of dense long setae apically, first metasomal tergite with spiracle at or just in front of midpoint and first metasomal sternite extending beyond the spiracle (Broad et al. 2018). Sexual dimorphism is evident within *Microleptes* though only few species are known from both sexes.

The aim of this work is to study material of *Microleptes* from India and Thailand, describe new species, and provide new faunistic records and a key to the world species.

## Materials and methods

Specimens were collected by Malaise traps and sweep nets in different parts of India (south and north-east of the country) and Thailand. The holotypes of the Indian species are deposited in the National Zoological Collections of the Zoological Survey of India, Western Ghat Regional Centre, Kozhikode (**ZSIK**) whereas the type specimen of the Thai species is deposited at the Queen Sirikit Botanic Garden, Chiang Mai, Thailand (**QSBG**). Paratype specimens of Indian species are deposited at the ATREE Insect Museum, Bangalore (**AIMB**). Images of Indian species and *M. xinbinensis* were taken with a Keyence VHX-6000 digital microscope and images of *M. depressus* sp. nov. were taken with a Leica M205 C stereomicroscope with a DMC5400 Camera, stacked in LASX (ver. 3.7.4.23463). Morphological terminology follows Broad et al. (2018). For cuticular sculpture we follow Harris (1979). The measurements of morphological structures were taken at longest and broadest points in appropriate view. Abbreviations used in the text: **OOL** – ocular-ocellar line, **POL** – postocellar line.

## Results

### Taxonomy

**Order Hymenoptera Linnaeus, 1758**

**Superfamily Ichneumonoidea Latreille, 1802**

**Family Ichneumonidae Latreille, 1802**

**Subfamily Microleptinae Townes, 1958**

### *Microleptes* Gravenhorst, 1829

*Microleptes* Gravenhorst, 1829. Type species: *Microleptes splendidulus* Gravenhorst. Monobasic.

*Miomeris* Förster, 1868. Type species: *Miomeris aquisgranensis* Förster. Designated by Förster (1871).

*Gnathoniella* Schmiedeknecht, 1924. Type species: *Gnathoniella egregia* Schmiedeknecht (= *Miomeris rectangulus* Thomson). Monobasic.

**Diagnosis.** Body robust, in many species somewhat dorsoventrally depressed (Figs 1A, 3A, 5A, 7A, 9A, 11A). Head mostly wider than long (Figs 1B, 3B, 5B, 7B, 9B) rarely as long as wide (Fig. 11B). Face anteriorly usually protruding below antennal sockets (Figs 1D, 3A, E, 7A). Clypeus transverse, weakly separated from face (Figs 1B, 3B, 5B, 7B, 9B). Subocular sulcus present (Figs 1B, 3B, 5B, 7B, 9B). Mandible mostly with undivided single broad tooth, if divided lower tooth smaller than upper tooth (Figs 1B, 3B, C, 5B, 7B, 9B). Temple long (Figs 1C, D, 3A, D, E, 5C, 7C, 9C, D, 11C, D). Occipital carina complete (Figs 1C, 3D, 9C, 11C). Scape subcylindrical (Figs 1D, 3A, E). Antennae with 14–18 flagellomeres. Flagellomeres from longer than wide (Figs 9A,

11A) to distinctly transverse (Figs 1A, 3A, E, 7A, C). Male flagellum with tyloids present on flagellomeres 1–2, 1–3 or 5–9 in the form of longitudinal ridges. Epomia absent (Figs 1F, 4A, 5F, 7E, 9F, 11D). Mesoscutum with lateral longitudinal groove (Figs 1E, 4B, 5D, 7D, 9E, 11E). Notauli only impressed anteriorly (Figs 1E, 4B, 5D, 7D, 9E, 11E). Scuto-scutellar groove smooth, undivided, lateral carina of the mesoscutum not crossing scuto-scutellar groove (Figs 1E, 4B, 5D, 7D, 9E, 11E). Epicnemial carina present, extending to subtegular ridge, mostly with a deep groove (Figs 1F, 4A, 5E, 7E, 9F, 11D). Propodeum smooth or sculptured with distinct carination associated with wrinkles or rugosity (Figs 4C, 5F, 6A, 7F, 10A, 11F). Anterior transverse carina (costula) present or absent (Figs 4C, 5F, 6A, 7F, 10A, 11F). Area basalis and area superomedia confluent (Figs 4C, 5F, 6A, 7F, 10A, 11F). Posterior transverse carina usually complete (Figs 4C, 5F, 6A, 7F, 10A, 11F). Hind femur mostly robust (Figs 1A, 2C, 3A, 5A, 6A). Hind tibia with apical fringe of dense long setae on inner side. Claw simple, without basal lobe. Fore wing without areolet (vein 3rs-m absent) (Figs 2B, 4F, 6D, 8D, 10F, 12D); vein 2m-cu with one bulla (Figs 2B, 4F, 6D, 8D, 10F, 12D); vein M&RS strongly curved (Figs 2B, 4F, 6D, 8D, 10F, 12D); vein 1cu-a interstitial to postfurcal (Figs 2B, 4F, 6D, 8D, 10F, 12D). First metasomal tergite without glymma, spiracle situated near mid-length of tergite (Figs 2C, 4D, 6A, 8A, 10C). First metasomal sternite extending to mid-length of segment, fused with tergite (Figs 2C, 4D, 6A, 8A, 10C). Second metasomal tergite with thyridium (Figs 2D, 4E, 6B, 8B, 10D, 12B). Ovipositor shorter than apical height of metasoma, ovipositor sheath setose (Figs 2C, 4D, 6A, 8A, 12A).

**Distribution.** Holarctic and Oriental regions.

**Biology.** Two species have been reared from Stratiomyidae (Diptera) (Wahl 1986; Schwarz 1991).

### Key to *Microleptes* species

- 1 All flagellomeres elongate in both sexes; first flagellomere  $3.6\text{--}4.8 \times$  as long as apical width (Fig. 11A); apical edge of clypeus clearly protruding, forming small tooth or tubercle in the middle (Fig. 11B); male antenna with tyloids on flagellomeres 5–7 ..... **2**
- Female flagellomeres, except for a few basal ones, usually transverse or subquadrate; first flagellomere less than  $3.0 \times$  as long as apical width (Figs 1A, 3A, E, 5A, 7A); apical edge of clypeus straight or slightly convex, without median tooth or tubercle (Figs 1B, 3B, C, 5B, 7B, 9B); male antenna with tyloids on flagellomeres 1–2 ..... **4**
- 2 Head in front view clearly tapered downwards, genae converging; mouth notch narrower than face width; head in dorsal view  $0.7 \times$  as long as wide; flagellomere 5 about  $3.0 \times$  as long as wide; male antenna with tyloids on flagellomeres 5–8 [Palearctic] ..... ***M. rectangulus* (Thomson, 1888)**
- Head in front view nearly rectangular, genae subparallel; mouth notch wider than face width (Fig. 11B); head in dorsal view  $0.8\text{--}0.9 \times$  as long as wide (Fig. 11C); flagellomere 5 shorter,  $1.8\text{--}2.1 \times$  as long as wide; male antenna with tyloids on flagellomeres 5–7 ..... **3**



- 3 Fore wing vein 1cu-a strongly postfurcal; hind coxa nearly smooth, yellow, slightly infusate anteriorly [Oriental (Myanmar)] .....  
 ..... ***M. malaisei* Kasparyan, 1998 (male unknown)**
- Fore wing vein 1cu-a nearly interstitial; hind coxa coriaceous with punctures, yellowish brown, strongly infusate in anterior half [East Palaearctic (China) and Oriental regions (India)]..... ***M. xinbinensis* Sheng & Sun, 2014**
- 4 Males (unknown for *M. chiani* sp. nov., *M. depressus* sp. nov., *M. gowrishankari* sp. nov., *M. minor*, *M. sandeshkaduri* sp. nov., *M. spasskii*, *M. tibialis*) ..... **5**
- Females (unknown for *M. belokobylskii*, *M. grandis*, *M. tehriensis* sp. nov.) ..... **13**
- 5 Propodeum, metasomal tergites and hind coxa polished; propodeal carination well developed, including distinct costula ..... **6**
- Propodeum, metasomal tergites and hind coxa matt, if weakly polished, then propodeal carination sometimes reduced and costula absent ..... **8**
- 6 Temples slightly narrowed posteriorly in dorsal view [West Palaearctic] .....  
 ..... ***M. obenbergeri* Gregor, 1938**
- Temples subparallel in dorsal view ..... **7**
- 7 Mesoscutum sparsely setose; fore wing with marginal cell longer than deep; flagellomeres 1 and 2 laterally concave; tyloids on flagellomeres 1–2; hind femur more robust,  $3.7\text{--}4.3 \times$  as long as wide; OOL  $1.5\text{--}1.6 \times$  diameter of lateral ocellus [Holarctic] .....  
 ..... ***M. splendidulus* Gravenhorst, 1829 (= *Miomeris glabriventris* Thomson, 1888)**
- Mesoscutum densely setose; fore wing with marginal cell short, deeper than long; flagellomeres 1 and 2 slender and parallel-sided; tyloids on flagellomeres 1–3; hind femur slenderer,  $4.8\text{--}5.1 \times$  as long as wide; OOL  $1.0 \times$  diameter of lateral ocellus [Nearctic] ..... ***M. rallus* Dasch, 1992**
- 8 First flagellomere as long as second flagellomere; propodeum without costula; posterior margin of apical sternite with a median process [Palaearctic] .....  
 ..... ***M. salisburgensis* Schwarz, 1991**
- First flagellomere shorter than the second; propodeum with distinct costula; posterior margin of apical sternite not protruding (except *M. aquisgranensis*) ..... **9**
- 9 Antenna with 18 flagellomeres; comparatively large species, with body length about 7.5 mm and fore wing length 5.3 mm [first flagellomere  $1.6 \times$  as long as wide posteriorly, second flagellomere  $1.5 \times$  as long as first flagellomere; tyloids on flagellomeres 1–2; first tergite coriaceous, with longitudinal striation; first sternite reaches 0.4, spiracles 0.4 of segment length; hind coxa yellow] [East Palaearctic] ..... ***M. grandis* Humala, 2003**
- Antenna with 16–17 flagellomeres; smaller species, with body length less than 5.0 mm and fore wing length not exceeding 4.0 mm ..... **10**
- 10 Flagellomeres 1–2 with tyloids ..... **11**
- Flagellomeres 1–3 with tyloids ..... **12**
- 11 Antenna as long as hind wing, with 16 flagellomeres; flagellomere 2 with tyloid in basal 0.5–0.6; malar space short, less than half as long as basal width of mandible; hind femur  $4.7 \times$  as long as wide, dorsal surface slightly convex; posterior

- margin of apical sternite with a median process [East Palaearctic].....  
 ..... ***M. orientalis* Humala, 2003**
- Antenna as long as fore wing, with 17 flagellomeres (Fig. 9A); flagellomere 2 with tyloid in basal 0.7; malar space as long as basal width of mandible (Fig. 9B, D); hind femur  $5.6 \times$  as long as wide, dorsal surface somewhat concave (Fig. 10C); posterior margin of apical sternite without process [Oriental] .....  
 ..... ***M. tehriensis* sp. nov.**
- 12 Malar space half as long as basal width of mandible; hind leg stouter, hind femur  $4.0 \times$  as long as wide; propodeum with distinct lateral portions of anterior transverse carina; posterior margin of apical sternite angularly protruding medially [East Palaearctic] ..... ***M. belokobylskii* Humala, 2003**
- Malar space as long as basal width of mandible; hind leg slenderer; propodeum roughly sculptured, only posterior transverse carina present; posterior margin of apical sternite nearly straight [Palaearctic]..... ***M. aquisgranensis* (Förster, 1871)**
- 13 Hind femur stout,  $2.7\text{--}3.7 \times$  as long as wide; median flagellomeres quadrate or transverse; second and following metasomal tergites and hind coxa mostly polished ..... **14**
- Hind femur slender,  $4.1\text{--}5.1 \times$  as long as wide; median flagellomeres distinctly elongate; second and following metasomal tergites and hind coxa mostly matt, if weakly shining, hind femur  $5.0 \times$  as long as wide..... **20**
- 14 Antenna nearly as long as mesosoma. First flagellomere as long as second flagellomere, twice as long as wide; hind tibia strongly swollen,  $1.1 \times$  as wide as hind femur; thyridium absent. [East Palaearctic] ..... ***M. tibialis* Humala, 2003**
- Antenna much longer than mesosoma. First flagellomere distinctly longer than second flagellomere, hind tibia not swollen, narrower than hind femur; thyridium distinct ..... **15**
- 15 Head  $1.1 \times$  as wide as long dorsally (Fig. 3D); temple long,  $1.1 \times$  as long as eye in dorsal view (Fig. 3D) [Oriental] ..... ***M. depressus* sp. nov.**
- Head  $1.3\text{--}1.4 \times$  as wide as long dorsally; temple  $0.6\text{--}0.7 \times$  as long as eye in dorsal view (Figs 1C, 5C, 7C)..... **16**
- 16 Fore wing vein 2rs-m  $0.6\text{--}0.9 \times$  as long as 2m-cu (Figs 2B, 6D); first flagellomere  $1.3 \times$  as long as wide (Figs 1D, 5B); hind femur  $2.5\text{--}2.8 \times$  as long as wide (Figs 2C, 6B) ..... **17**
- Fore wing vein 2rs-m half as long as 2m-cu; first flagellomere more than  $1.5 \times$  longer than its width; hind femur  $3.0\text{--}3.7 \times$  as long as wide..... **18**
- 17 Face with trapezoidal protrusion and without longitudinal depression (Fig. 5B); pronotum transversely striate medio-anteriorly (Fig. 5D); mesopleuron without sternaulus; costula absent (Fig. 5F); vein 2rs-m  $0.6 \times$  as long as 2m-cu; third tergite transverse (Fig. 6B) [Oriental] ..... ***M. gowrishankari* sp. nov.**
- Face without such protrusion and with longitudinal median depression (Fig. 1B); pronotum punctate medio-anteriorly (Fig. 1E); mesopleuron with distinct sternaulus; costula present (Fig. 2A); vein 2rs-m  $0.9 \times$  as long as 2m-cu (Fig. 2B); third tergite quadrate (Fig. 2D) [Oriental] ..... ***M. chiani* sp. nov.**

- 18 Median flagellomeres quadrate or slightly transverse; first flagellomere slightly and evenly widened apically; temples widened posteriorly in dorsal view [West Palaearctic] ..... ***M. obenbergeri* Gregor, 1938**
- Median flagellomeres distinctly transverse; first flagellomere sharply widened apically; temples shorter, subparallel in dorsal view ..... **19**
- 19 Hind femur more robust,  $3.0\text{--}3.3 \times$  as long as wide; POL longer than OOL; OOL  $1.75\text{--}2.0 \times$  diameter of lateral ocellus; marginal cell elongate [Palaearctic] ..... ***M. splendidulus* Gravenhorst, 1829 (= *Miomeris glabriventris* Thomson, 1888)**
- Hind femur  $3.8 \times$  as long as wide (Fig. 8A); POL shorter than OOL; OOL  $1.6 \times$  diameter of lateral ocellus (Fig. 7C); marginal cell short (Fig. 8D) [Oriental] ..... ***M. sandeshkaduri* sp. nov.**
- 20 First flagellomere longer than second flagellomere ..... **21**
- First flagellomere distinctly shorter than second flagellomere ..... **22**
- 21 First flagellomere  $2.2\text{--}2.4 \times$  as long as wide posteriorly; malar space shorter,  $0.5\text{--}0.6 \times$  as long as basal width of mandible; face at level of antennal sockets with a strong rectangular protrusion, bordered below by a carina down-curved laterally; propodeum wrinkled, weakly shining, costula lacking [Palaearctic] ....  
..... ***M. salisburgensis* Schwarz, 1991**
- First flagellomere  $1.9 \times$  as long as wide posteriorly; malar space as long as basal width of mandible; face at level of antennal sockets with V-shaped protrusion not bordered by carina; propodeum coriaceous, all carinae developed excluding anterior transverse carina [East Palaearctic] ..... ***M. spasskii* Humala, 2003**
- 22 Face with V-shaped protrusion below antennal sockets not bordered below by carina; propodeum roughly sculptured, all carinae reduced, excluding posterior transverse carina; hind coxa brown [Palaearctic] ..... ***M. aquisgranensis* (Förster, 1871)**
- Face with V-shaped protrusion below antennal sockets with irregular sculpture, bordered below by carina; propodeum coriaceous, all carinae well developed excluding anterior transverse carina; hind coxa mostly yellow ..... **23**
- 23 Antenna slender, first flagellomere  $4.0 \times$  as long as wide; second flagellomere  $4.7 \times$  as long as wide; propodeum polished [Nearctic] ..... ***M. rallus* Dasch, 1992**
- Antenna stouter, first flagellomere  $2.1\text{--}2.2 \times$  as long as wide posteriorly; second flagellomere  $3.0\text{--}3.4 \times$  as long as wide posteriorly,  $1.3\text{--}1.5 \times$  as long as first flagellomere; propodeum coriaceous ..... **24**
- 24 Malar space  $0.7 \times$  as long as basal width of mandible; first flagellomere evenly widened,  $2.2 \times$  as long as wide; second flagellomere  $1.5 \times$  as long as first flagellomere; first sternite reaching  $0.5 \times$  tergite length; hind tibia with subbasal inflation evenly widened to apex. Larger species, fore wing 3.8 mm [East Palaearctic] ..... ***M. orientalis* Humala, 2003**
- Malar space  $1.2 \times$  as long as basal width of mandible; first flagellomere  $2.1 \times$  as long as wide; second flagellomere  $1.3 \times$  as long as first flagellomere; first sternite reaching  $0.6 \times$  tergite length; hind tibia somewhat constricted between subbasal inflation and apex. Smaller species, fore wing 2.9 mm [East Palaearctic] .....  
..... ***M. minor* Humala, 2003**

***Microleptes chiani* Ranjith & Humala, sp. nov.**

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Figs 1, 2

**Material examined.** *Holotype* • female, INDIA: Tamil Nadu, Kalakad Mundanthurai Tiger Reserve (KMTR), tropical wet evergreen forest, understorey, Malaise trap, 5.x.2008, coll. Priyadarsanan, D.R. (ZSIK) Regd. No. ZSI/WGRC/IR/INV.27406.

**Description.** *Holotype, female.* Body length 6.2 mm, fore wing length 3.7 mm.

**Head.** Head  $1.6 \times$  as wide as long in anterior view (Fig. 1B) and  $1.4 \times$  as wide as long in dorsal view (Fig. 1C); face flat, punctate, elevated anteriorly below antennal sockets, setose,  $1.7 \times$  as wide as long (Fig. 1A, B, D); clypeus strongly transverse, smooth, with lower margin slightly convex (Fig. 1B); tentorial pits transverse (Fig. 1B); malar space strongly reduced,  $0.3 \times$  basal width of mandible (Fig. 1B, C); mandible broad with single broad tooth (Fig. 1B); temple smooth, setose (Fig. 1D); frons and vertex smooth and sparsely setose (Fig. 1C); eye glabrous,  $1.5 \times$  as long as temple in dorsal view (Fig. 1B–D); OOL : diameter of lateral ocellus : POL =  $1.4 : 1.0 : 1.2$ ; antenna with 14 flagellomeres; scape subcylindrical, pedicel bulb-shaped (Fig. 1B, D); medial flagellomeres strongly transverse (Fig. 1A); first flagellomere  $2.0 \times$  as long as second flagellomere,  $1.3 \times$  as long as wide; second flagellomere  $0.6 \times$  as long as wide.

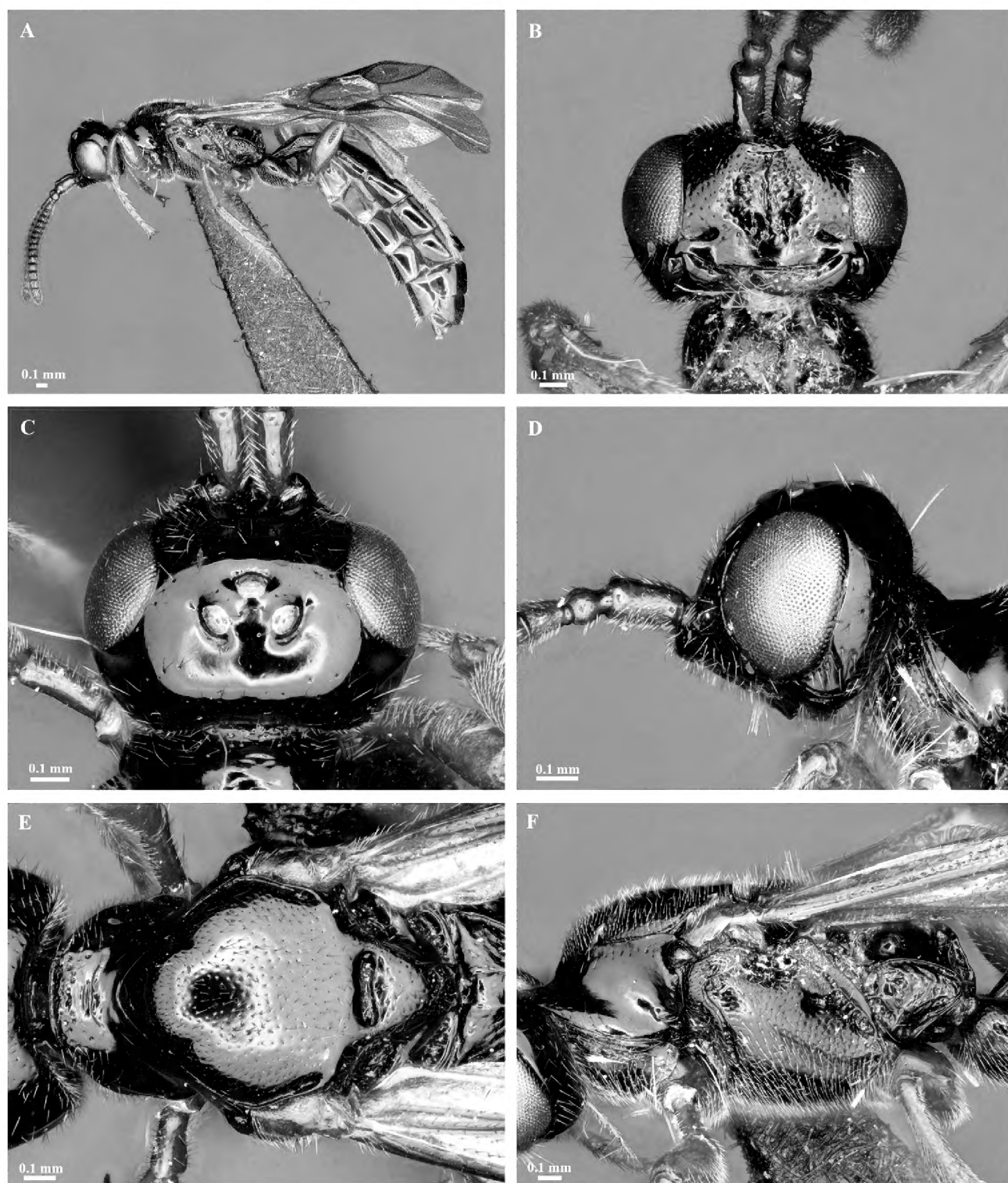
**Mesosoma.** Mesosoma  $1.8 \times$  as long as high (Fig. 1F); dorsal part of pronotum rugose-punctate medially, transversely wrinkled posteriorly (Fig. 1E), pronotum laterally smooth and polished (Fig. 1F); mesoscutum flat in lateral view, punctate, setose with a pair of elongate pits postero-laterally (Fig. 1F); notaulus present anteriorly (Fig. 1E); scuto-scutellar groove smooth without wrinkles (Fig. 1E); scutellum smooth, setose (Fig. 1E); mesopleuron smooth, setose (Fig. 1F); mesopleural furrow widely crenulated (Fig. 1F); epicnemial carina present, joining with subtegular ridge and forming a smooth continuous groove anteriorly (Fig. 1F); metapleuron entirely rugulose, sparsely setose, sternaulus absent (Fig. 1F); propodeum rugulose, area superomedia smooth medially, faintly crenulated postero-laterally, slightly narrowing anteriorly, parallel-sided posteriorly; costula present (Fig. 2A); posterior transverse carina present, area dentipara slightly longer than wide, smooth medially; rest rugulose; pleural carina complete (Fig. 2A).

**Legs.** Femora slender (Fig. 1A); hind coxa smooth (Figs 1A, 2C); hind femur  $2.5 \times$  as long as wide; hind tibia  $3.3 \times$  as long as wide; hind basitarsus  $3.8 \times$  as long as wide.

**Wings.** Wings hyaline (Fig. 2B); pterostigma  $2.8 \times$  as long as wide; fore wing vein  $2r+RS$  joining to pterostigma before its middle,  $1.1 \times$  as long as  $2rs-m$ ; vein  $2rs-m$   $2.5 \times$  as long as  $M$  between  $2rs-m$  and  $2m-cu$ ; and  $0.9 \times$  as long as  $2mc-u$ ; vein  $1cu-a$  slightly postfurcal (Fig. 2B); hind wing with nervellus (vein  $CU$ ) intercepted in middle.

**Metasoma.** First tergite faintly sculptured medially, setose with indistinct dorsal carina,  $2.3 \times$  as long as its maximum width, spiracle situated at middle of tergite (Fig. 2C, D); second tergite with distinct thyridium, smooth, setose,  $1.1 \times$  as long as wide posteriorly (Fig. 2D); third tergite smooth, setose, as long as wide posteriorly (Fig. 2D); tergites 4–7 smooth, setose (Fig. 2D); hypopygium straight posteriorly; ovipositor hardly exposed, sheath apically setose,  $0.1 \times$  as long as hind tibia (Fig. 2C).





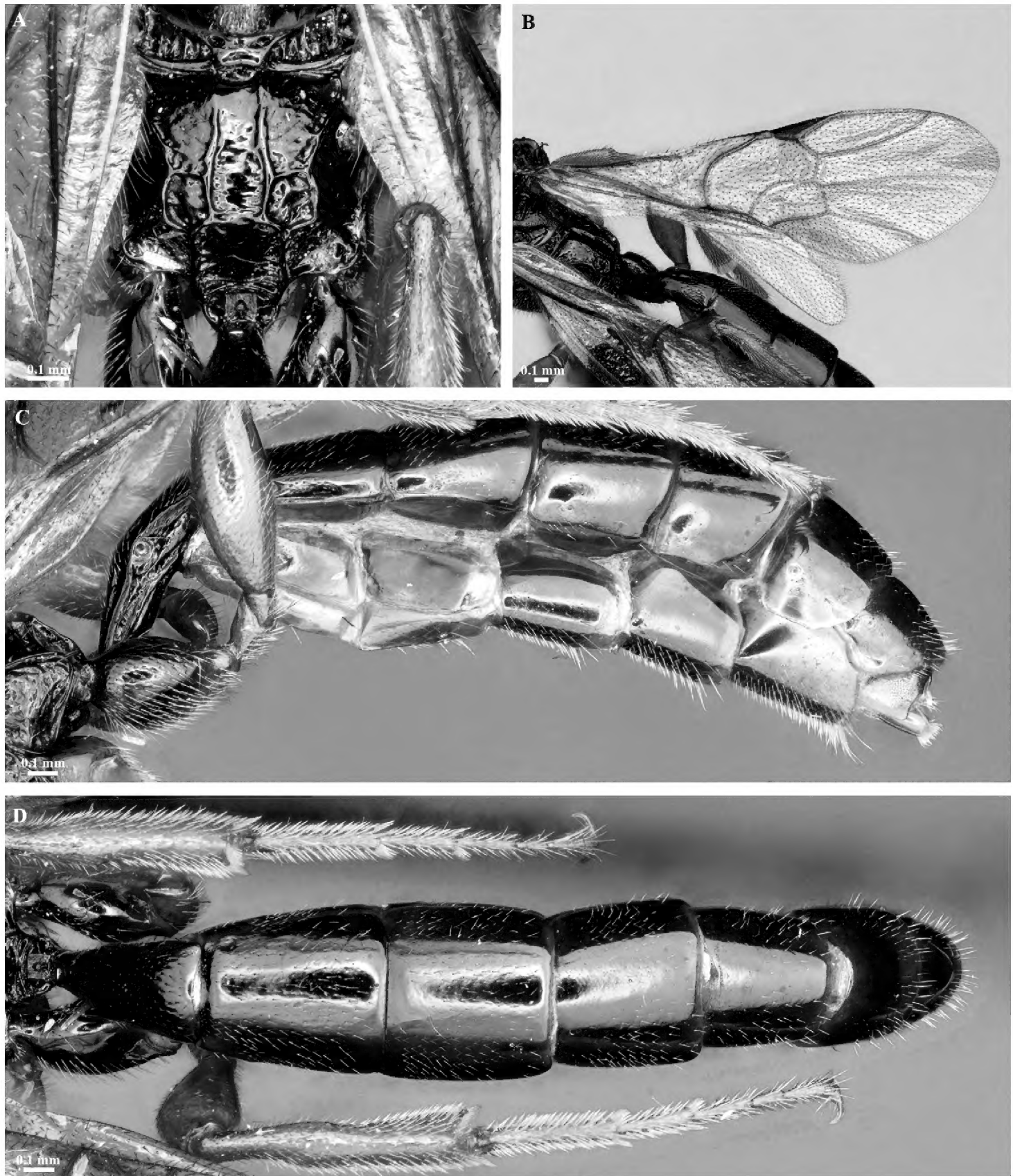
**Figure 1.** *Microleptes chiani* Ranjith & Humala, sp. nov., holotype, female **A** habitus, lateral view **B** head, anterior view **C** head, dorsal view **D** head, lateral view **E** mesosoma, dorsal view **F** mesosoma, lateral view.

**Colour.** Body predominantly black; antenna, mandible, tegula; pterostigma, wing veins, coxae and metasoma dark brown; maxillary and labial palps, legs (except coxae) yellow.

**Male.** Unknown.

**Distribution.** India.

**Etymology.** The new species is named after our field assistant Mr. Thamilselvan, whom we fondly call 'Chian', who contributed much in establishing insect collection from the difficult terrain of KMTR.



**Figure 2.** *Microleptes chiani* Ranjith & Humala, sp. nov., holotype, female **A** propodeum, dorsal view **B** fore wing **C** metasoma, lateral view **D** metasoma, dorsal view.

**Comparative diagnosis.** Apart from the differences given in the key, the new species differs from *M. gowrishankari* sp. nov. by the following characters: head  $1.6 \times$  as wide as long in anterior view ( $1.3 \times$  in *M. gowrishankari* sp. nov.), face  $1.7 \times$  as wide as long ( $2.4 \times$  in *M. gowrishankari* sp. nov.), epicnemial area with complete groove behind epicnemial carina (incomplete in *M. gowrishankari* sp. nov.) and area dentipara of propodeum longer than wide (wider than long in *M. gowrishankari* sp. nov.).

***Microleptes depressus* Ranjith & Humala, sp. nov.**

<https://zoobank.org/F50738F1-7A48-4DC1-8BAB-4228128DA703>

Figs 3, 4

**Material examined.** *Holotype* • female, THAILAND: Kamphaeng Phet, Malaise trap, 3–10.ix.2007, coll. Chumpol Piluk & Aram Inpuang (QSBG).

**Description.** *Holotype, female.* Body length 6.5 mm, fore wing length 4.0 mm.

**Head.** Head  $1.5 \times$  as wide as long in anterior view (Fig. 3B) and  $1.1 \times$  as wide as long in dorsal view (Fig. 3D); face flat, sparsely punctate, elevated anteriorly below antennal sockets, setose,  $2.7 \times$  as wide as long (Fig. 3A, B, C, E); clypeus strongly transverse, smooth, lower margin weakly convex (Fig. 3B, C); tentorial pits rounded (Fig. 3B); malar space short,  $0.5 \times$  basal width of mandible; mandible broad with two teeth, upper tooth longer and wider than lower tooth (Fig. 3B, C); vertex and temple strongly enlarged, temple  $1.1 \times$  as long as eye in dorsal view, sparsely punctate laterally, with sparse setae (Fig. 3D, E); frons and vertex polished, sparsely punctate and setose (Fig. 3D); eye glabrous (Fig. 3); OOL : diameter of lateral ocellus : POL = 1.8 : 1.0 : 1.1; antenna with 14 flagellomeres; scape subcylindrical, pedicel bulb-shaped (Fig. 3A, E); medial flagellomeres distinctly transverse (Fig. 3A, E); first flagellomere  $1.5 \times$  as long as second flagellomere and  $1.3 \times$  as long as wide; second flagellomere  $0.9 \times$  as long as wide.

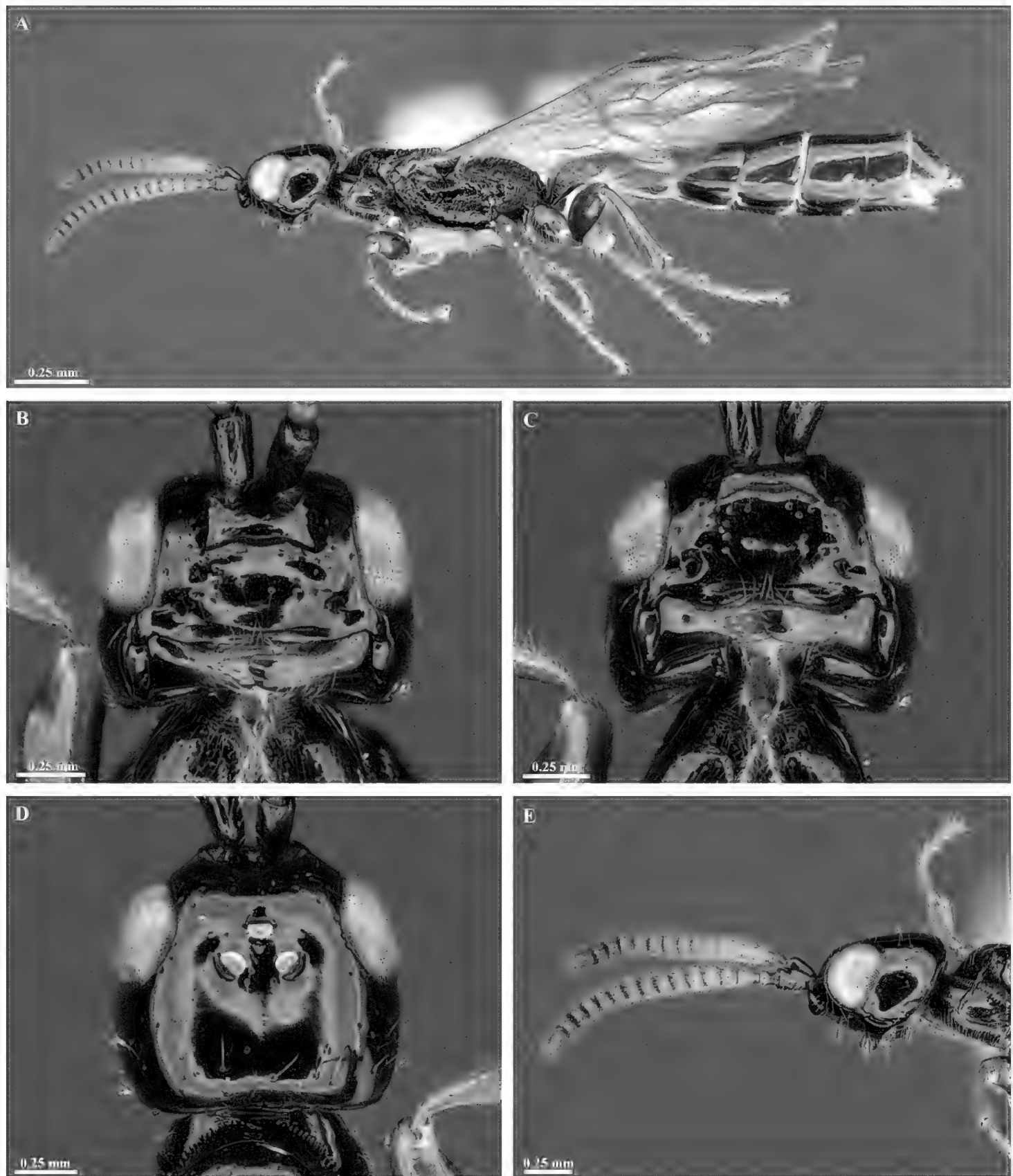
**Mesosoma.** Mesosoma elongate,  $2.8 \times$  as long as high (Figs 3A, 4A); dorsal part of pronotum crenulated medially (Fig. 4B), pronotum laterally smooth and polished, crenulated medially (Fig. 4A); mesoscutum flat in lateral view (Fig. 4A), smooth, setose only medially (Fig. 4B); notaulus present anteriorly (Fig. 4B); scuto-scutellar groove smooth without wrinkles (Fig. 4B); scutellum smooth, setose laterally and posteriorly (Fig. 4B); mesopleuron coriaceous, setose (Fig. 4A); mesopleural furrow indistinct (Fig. 4A); epicnemial carina present, joining with subtegular ridge (Fig. 4A); metapleuron rugose with transverse wrinkles medially, sparsely setose (Fig. 4A); propodeum punctate in anterior half, transversely striate-rugose in posterior half, combined area basalis+superomedia narrowed in anterior  $0.3$ , with irregular transverse wrinkles, costula absent, posterior transverse carina present; pleural carina complete (Fig. 4C).

**Legs.** Femora robust (Fig. 1A); hind coxa smooth (Fig. 4D); hind femur  $2.9 \times$  as long as wide (Fig. 4A, D); hind tibia  $3.3 \times$  as long as wide; hind basitarsus  $4.7 \times$  as long as wide (Fig. 4D).

**Wings.** Wings hyaline (Fig. 4F); pterostigma  $3.2 \times$  as long as wide; fore wing vein 2r&RS joining to pterostigma before its middle,  $2.3 \times$  as long as 2rs-m (Fig. 4F); vein 2rs-m  $1.7 \times$  as long as M between 2rs-m and 2m-cu; vein 1cu-a distinctly postfurcal (Fig. 4F); hind wing vein with nervellus (CU) intercepted in middle.

**Metasoma.** First metasomal tergite strongly convex in lateral view (Fig. 4D), sparsely punctate, setose with pair of weak dorsal carinae, twice as long as its maximum width; spiracle situated at middle of tergite (Fig. 4D–F); second tergite polished with distinct thyridium, sparsely punctate, setose,  $1.1 \times$  as long as wide (Fig. 4E, F); third tergite polished, as long as wide (Fig. 4E, F); tergites 4–7 polished, scarcely setose





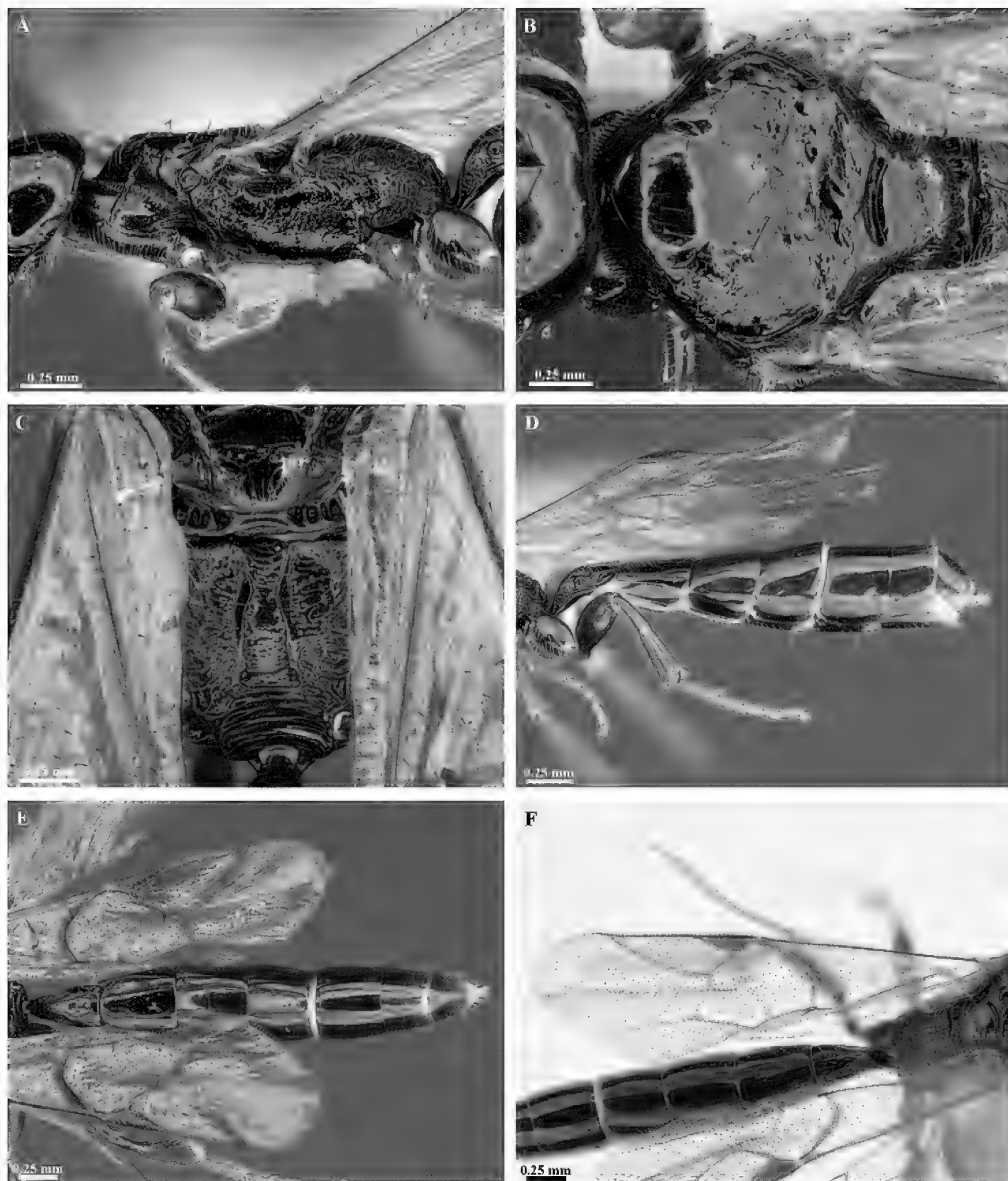
**Figure 3.** *Microleptes depressus* Ranjith & Humala, sp. nov., holotype, female **A** habitus, lateral view **B** head, anterior view **C** head, antero-ventral view **D** head, dorsal view **E** antenna and head, lateral view.

laterally; hypopygium straight posteriorly; ovipositor hardly exposed; sheath setose,  $0.2 \times$  as long as hind tibia (Fig. 4D, E).

**Colour.** Body predominantly black; antenna, mandible, tegula, fore leg (excluding tibia and tarsus), hind leg (except tarsus) and tergites 3–7 reddish brown; flagellomeres 1–4, fore tibia and tarsus, mid leg, hind tarsus, posterior margin of hypopygium and ovipositor sheath yellow.

**Male.** Unknown.





**Figure 4.** *Microleptes depressus* Ranjith & Humala, sp. nov., holotype, female **A** mesosoma, lateral view **B** mesosoma, dorsal view **C** propodeum, dorsal view **D** metasoma, lateral view **E** metasoma, dorsal view **F** fore wing.

**Distribution.** Thailand.

**Etymology.** The new species is named after the distinctly depressed body.

**Comparative diagnosis.** The new species is similar to *M. tibialis*, but differs from this species by antenna as long as mesosoma length ( $1.4 \times$  as long as mesosoma in *M. tibialis*), first flagellomere longer than second flagellomere (as long as second flagellomere in *M. tibialis*), temple  $1.1 \times$  as long as eye in dorsal view, hind tibia not swollen, not wider than hind femur (hind tibia strongly swollen,  $1.1 \times$  as wide as hind femur in *M. tibialis*), distinct thyridium (lacking in *M. tibialis*).

***Microleptes gowrishankari* Ranjith & Humala, sp. nov.**

<https://zoobank.org/B9A56B80-AF79-4B68-A10A-E2FC1558BE4C>

Figs 5, 6

**Material examined.** *Holotype* • female, INDIA: Karnataka, Chamarajanagar, Biligiri Ranganathaswamy Temple Tiger Reserve, Gombekallu, 11°54.363'N, 77°11.235'E, evergreen forest, Malaise trap, 3.iv–16.v.2006, coll. Priyadarsanan, D.R. (ZSIK) Regd. No. ZSI/WGRC/IR/INV.27407. Paratype, 1 female with same data as holotype (AIMB).

**Description.** *Holotype, female.* Body length 5.6 mm, fore wing length 3.6 mm.

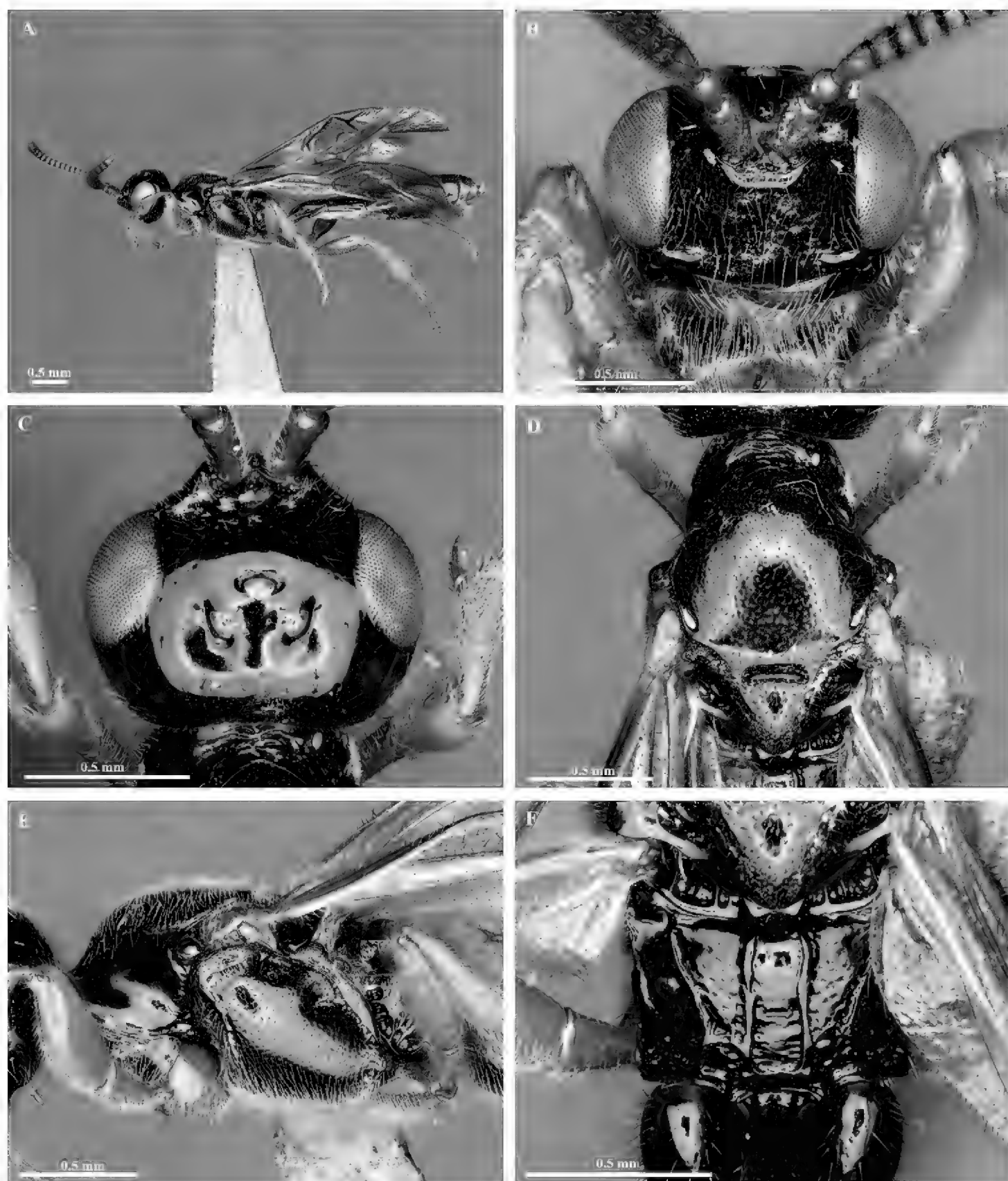
**Head.** Head  $1.3 \times$  as wide as long in frontal and dorsal views (Fig. 5B, C); face flat, punctate, elevated anteriorly below antennal sockets, setose,  $2.4 \times$  as wide as long,  $0.6 \times$  as wide as head (Fig. 5B); clypeus strongly transverse, smooth with lower margin convex (Fig. 5B); tentorial pits transverse (Fig. 5B); malar space strongly reduced,  $0.3 \times$  basal width of mandible (Fig. 5B); mandible broad with single broad tooth (Fig. 5B); temple smooth, sparsely setose (Fig. 5A); frons and vertex smooth and sparsely setose (Fig. 5C); eye glabrous,  $1.2 \times$  as long as temple in dorsal view (Fig. 5A–C); OOL : diameter of lateral ocellus : POL = 2.0 : 1.0 : 1.4; antenna with 14 flagellomeres, scape subcylindrical, pedicel bulb-shaped (Fig. 5A, B); medial flagellomeres strongly transverse; first flagellomere  $1.8 \times$  as long as second flagellomere,  $1.3 \times$  as long as wide apically; second flagellomere  $0.6 \times$  as long as wide.

**Mesosoma.** Mesosoma  $2.1 \times$  as long as high (Fig. 5E); dorsal part of pronotum transversely striate medially (Fig. 5D), pronotum laterally smooth and polished (Fig. 5E); mesoscutum flat in lateral view (Fig. 5E), smooth with setiferous punctures, and a pair of elongate pits postero-laterally (Fig. 5D); notaulus present anteriorly (Fig. 5D); scuto-scutellar groove smooth without wrinkles (Fig. 5D); scutellum smooth, setose (Fig. 5D); mesopleuron smooth, setose (Fig. 5E); mesopleural furrow narrowly crenulated (Fig. 5E); epicnemial carina present, joining with subtegular ridge and forming an interrupted, faintly crenulated groove anteriorly (Fig. 5E); metapleuron smooth with transverse wrinkles medially, sparsely setose (Fig. 5E); propodeum smooth basally, irregularly punctate laterally, rugose in posterior half; area superomedial parallel-sided, smooth in anterior half, irregularly transversely striate posteriorly; costula lacking; posterior transverse carina present, pleural carina complete (Fig. 5F).

**Legs.** Femora robust (Fig. 5A); hind coxa smooth; hind femur  $2.8 \times$  as long as wide; hind tibia  $3.4 \times$  as long as wide; hind basitarsus  $3.8 \times$  as long as wide.

**Wings.** Wings hyaline (Fig. 6D); pterostigma  $2.6 \times$  as long as wide; fore wing vein 2r&RS joining to middle of pterostigma,  $1.6 \times$  as long as 2rs-m; vein 2rs-m  $2.0 \times$  as long as portion of M between 2rs-m and 2m-cu, and  $0.6 \times$  as long as 2mc-u; vein 1cu-a distinctly postfurcal (Fig. 6D); hind wing with nervellus (vein CU) intercepted in middle.

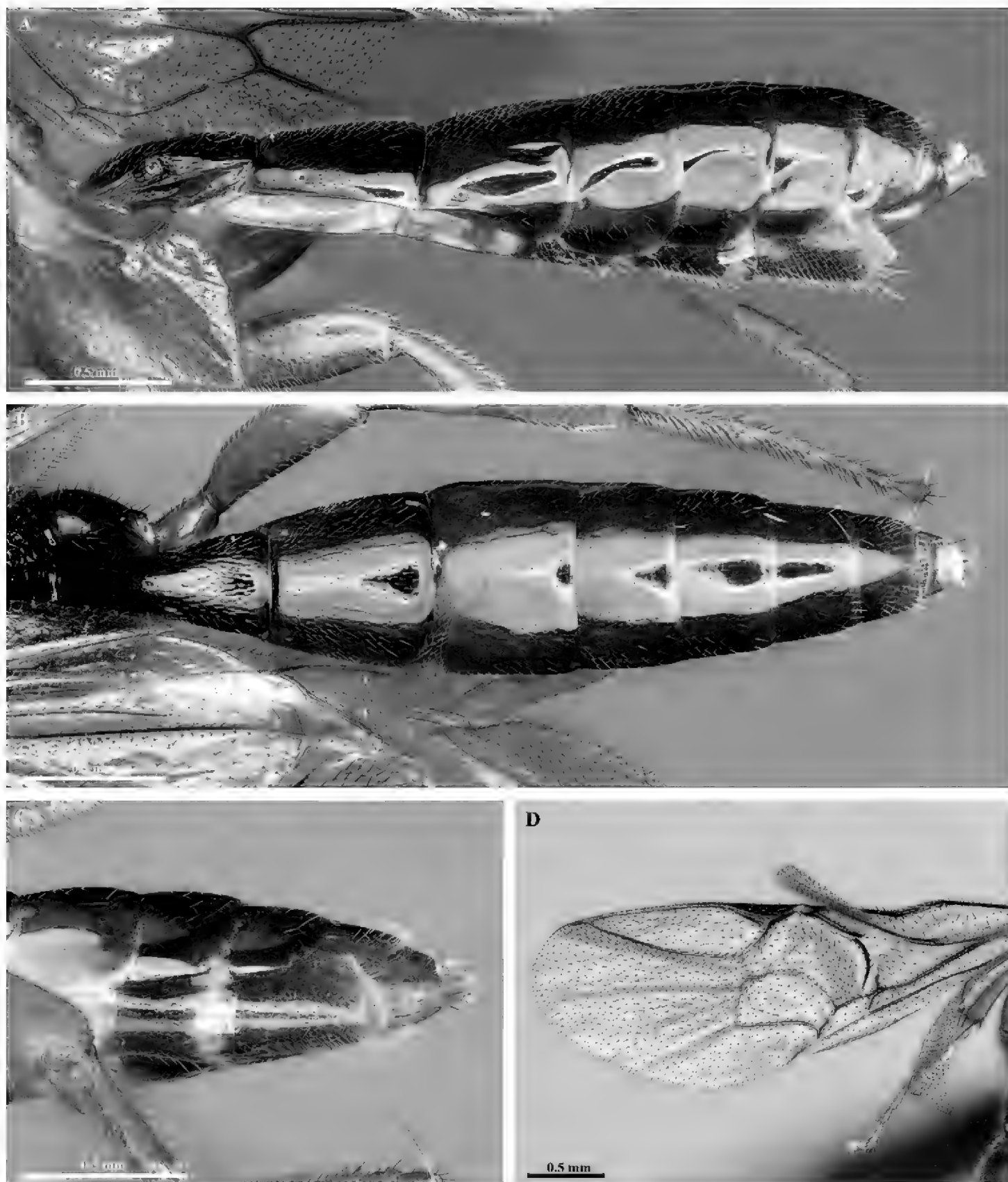
**Metasoma.** First tergite faintly sculptured medially, setose, with indistinct dorsal carina,  $1.7 \times$  as long as its maximum width; spiracle situated at middle of tergite (Fig. 6A, B); second tergite with distinct thyridium, smooth, setose,  $0.9 \times$  as long as wide posteriorly (Fig. 6B); third tergite smooth, setose,  $0.75 \times$  as long as wide



**Figure 5.** *Microleptes gowrishankari* Ranjith & Humala, sp. nov., holotype, female **A** habitus, lateral view **B** head, anterior view **C** head, dorsal view **D** mesosoma, dorsal view **E** mesosoma, lateral view **F** propodeum, dorsal view.

posteriorly (Fig. 6B); tergites 4–7 smooth, setose (Fig. 6B); hypopygium straight posteriorly, with long setae (Fig. 6C); ovipositor hardly exposed, its sheath setose,  $0.2 \times$  as long as hind tibia (Fig. 6A–C).

**Colour.** Body predominantly black; antenna, mandible, tegula; pterostigma, wing veins, coxae, metasoma dark brown; maxillary and labial palps and legs (except coxae) yellow.



**Figure 6.** *Microleptes gowrishankari* Ranjith & Humala, sp. nov., holotype, female **A** metasoma, lateral view **B** metasoma, dorsal view **C** apex of metasoma, ventral view **D** fore wing.

**Male.** Unknown.

**Distribution.** India.

**Etymology.** The new species is named after Dr. P. Gowri Shankar, founder director of Kalinga Foundation, Karnataka, India for his exceptional and unparalleled works, contributions to the study of the King Cobra over the past two decades, his contributions towards to the advancement of herpetology and his unwavering support to APR during Siang Expedition 2022.



**Comparative diagnosis.** Apart from the differences given in the key, the new species can be distinguished from *M. chiani* sp. nov. by the following characters: head  $1.3 \times$  as wide as long in anterior view ( $1.6 \times$  in *M. chiani* sp. nov.), face  $2.4 \times$  as wide as long ( $1.7 \times$  in *M. chiani* sp. nov.), epicnemial area with incomplete groove behind epicnemial carina (with complete groove in *M. chiani* sp. nov.) and area dentipara of propodeum wider than long (longer than wide in *M. chiani* sp. nov.).

***Microleptes sandeshkaduri* Ranjith & Humala, sp. nov.**

<https://zoobank.org/AF1C5F1F-F0AE-45D3-9BE2-84581D070A35>

Figs 7, 8

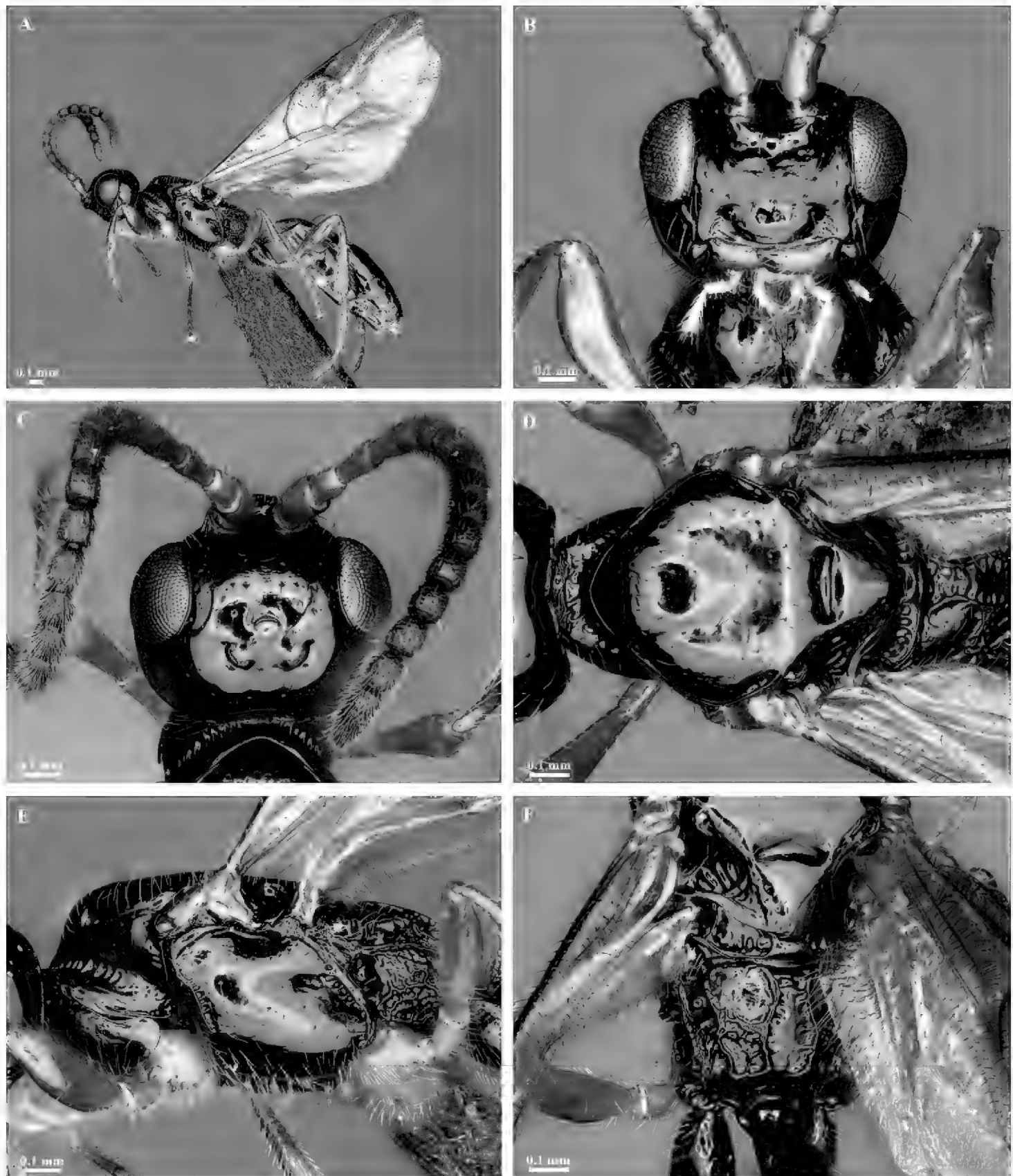
**Material examined. Holotype** • female INDIA: Arunachal Pradesh, Kuming River side,  $25^{\circ}98'78''\text{N}$ ,  $94^{\circ}98'04''\text{E}$ , 777 m.a.s.l., sweep net, 20.x.2022, coll. A.P. Ranjith (ZSIK) Regd. No. ZSI/WGRC/IR/INV.27408.

**Description. Holotype, female.** Body length 3.8 mm, fore wing length 2.9 mm.

**Head.** Head  $1.3 \times$  as wide as long in anterior view (Fig. 7B) and  $1.2 \times$  as wide as long in dorsal view (Fig. 7C); face flat, smooth, elevated anteriorly below antennal sockets and forming acute protrusion, sparsely setose,  $2.2 \times$  as wide as long (Fig. 7A, B); clypeus about  $2.5 \times$  as wide as long anteriorly, smooth, with lower margin convex (Fig. 7B); tentorial pits round (Fig. 7B); malar space  $1.4 \times$  basal width of mandible, with subocular sulcus; mandible broad with single broad tooth (Fig. 7B); temple smooth, setose (Fig. 7A); frons sparsely punctate; vertex smooth and sparsely setose (Fig. 7C); eye glabrous,  $1.1 \times$  as long as temple in dorsal view (Fig. 7B, C); OOL : diameter of lateral ocellus : POL = 1.5 : 1.0 : 1.0; antenna with 14 flagellomeres; scape subcylindrical, medial flagellomeres as long as wide (Fig. 7A–C); first flagellomere  $0.9 \times$  as long as second flagellomere,  $1.6 \times$  as long as wide; second flagellomere  $1.5 \times$  as long as wide.

**Mesosoma.** Mesosoma  $2.0 \times$  as long as high (Fig. 7E); dorsal part of pronotum crenulated medially, with transverse wrinkles anteriorly (Fig. 7D); pronotum laterally crenulated in middle (Fig. 7E); mesoscutum flat in lateral view, smooth, sparsely setose, with a pair of elongate pits postero-laterally (Fig. 7D, E); notaulus shallow, only impressed anteriorly (Fig. 7D); scuto-scutellar groove wide, smooth, without crenulations (Fig. 7D); scutellum smooth, setose, glabrous medially (Fig. 7D); mesopleuron smooth, setose (Fig. 7E); mesopleural furrow narrowly crenulated (Fig. 7E); epicnemial carina present, joining with subtegular ridge and forming a smooth crenulated continuous groove anteriorly (Fig. 7E); metapleuron coarsely rugose, sparsely setose (Fig. 7E); propodeum rugose, smooth baso-laterally; area superomedia narrowing anteriorly, widened medially, parallel-sided apically with crenulations laterally; costula indistinct; posterior transverse carina present; area dentipara longer than wide, rugose; pleural carina complete (Fig. 7F).

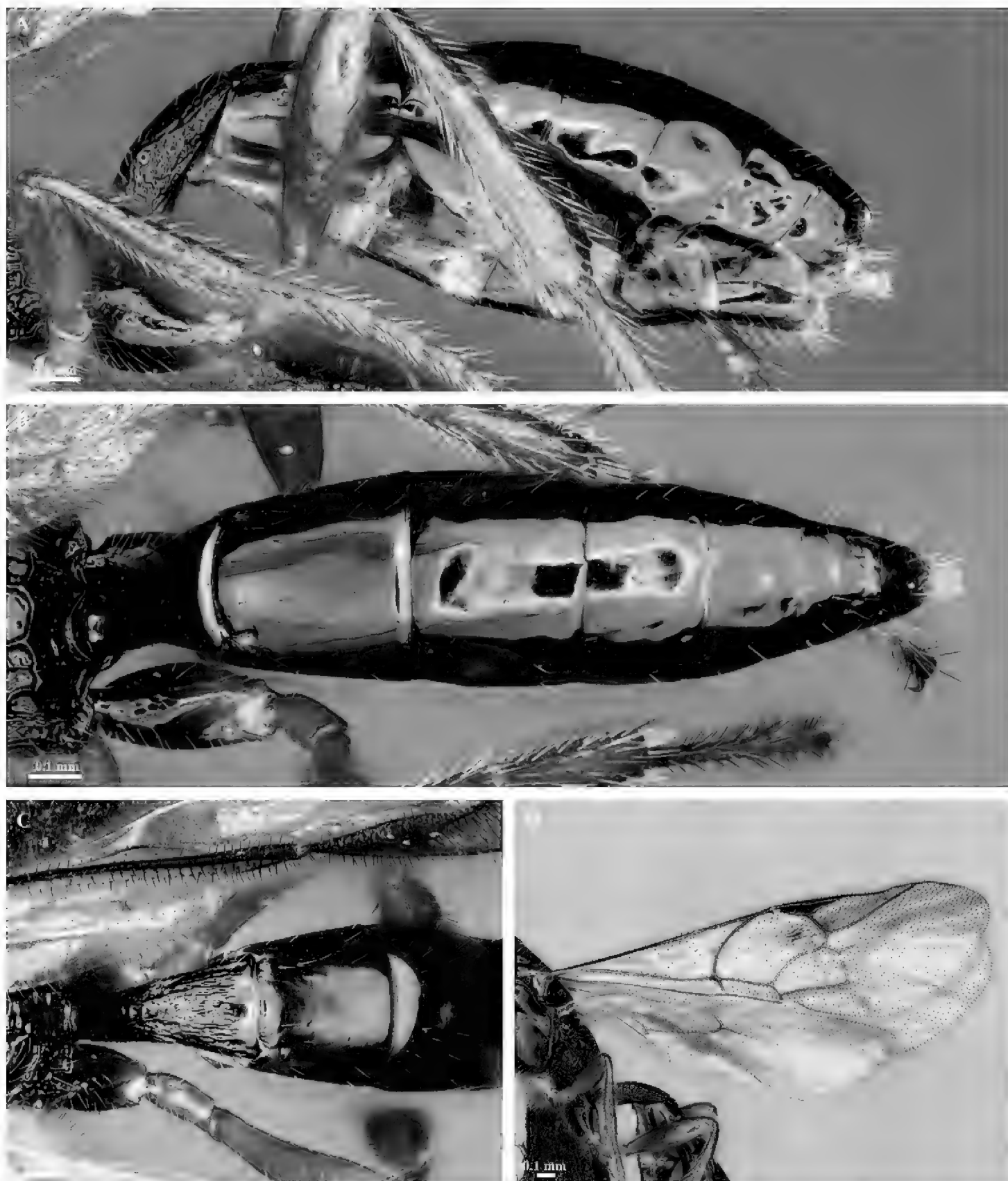
**Legs.** Femora robust (Fig. 7A); hind coxa smooth (Fig. 8A); hind femur  $3.8 \times$  as long as wide; hind tibia  $4.6 \times$  as long as wide; hind basitarsus  $4.4 \times$  as long as wide.



**Figure 7.** *Microleptes sandeshkaduri* Ranjith & Humala, sp. nov., holotype, female **A** habitus, lateral view **B** head, anterior view **C** head, dorsal view **D** mesosoma, dorsal view **E** mesosoma, lateral view **F** propodeum, dorsal view.

**Wings.** Wings hyaline (Fig. 8D); pterostigma  $2.8 \times$  as long as wide; fore wing vein  $2r+RS$  joining to pterostigma in middle,  $1.3 \times$  as long as  $2rs-m$ ; fore wing vein  $2rs-m$  as long as  $M$  between  $2rs-m$  and  $2m-cu$ ; vein  $1cu-a$  slightly postfurcal (Fig. 8D); hind wing with nervellus (vein  $CU$ ) intercepted in middle (Fig. 8D).

**Metasoma.** First metasomal tergite distinctly longitudinally striate-rugose, setose with strong dorsal carina, polished posteriorly (Fig. 8C);  $1.9 \times$  as long as wide; spiracle situated at middle of tergite (Fig. 8A); second tergite polished, sparsely setose,  $0.9 \times$



**Figure 8.** *Microleptes sandeshkaduri* Ranjith & Humala, sp. nov., holotype, female **A** metasoma, lateral view **B** metasoma, dorsal view **C** first metasomal tergite, dorsal view **D** wings.

as long as wide posteriorly, with distinct small thyridium (Fig. 8B); third tergite polished, sparsely setose,  $0.8 \times$  as long as wide posteriorly (Fig. 8B); tergites 4–7 polished, sparsely setose (Fig. 8B); hypopygium straight posteriorly; ovipositor hardly exposed; sheath setose apically,  $0.1 \times$  as long as hind tibia (Fig. 8A, B).

**Colour.** Body predominantly black; antenna except scape and pedicel, pterostigma, wing veins, hind coxa dark brown; scape, pedicel, mandible, maxillary and labial palps, tegula, fore and mid legs, hind leg except coxa and ovipositor sheath yellow.

**Male.** Unknown.

**Distribution.** India.

**Etymology.** The new species is named after Mr. Sandesh Kadur, Director of Felis Creations, Honorary Fellow of ATREE, Senior Fellow of the International League of Conservation Photographers and a National Geographic Explorer for his outstanding contributions towards the documentation, conservation and protection of the planet's biodiversity.

**Comparative diagnosis.** The new species is similar to *M. splendidulus* in having the median flagellomeres distinctly transverse and first flagellomere sharply widened apically. In addition to the differences given in the key, the new species differs from *M. splendidulus* in having the following characters: malar space  $1.4 \times$  as long as basal width of mandible ( $0.8 \times$  in *M. splendidulus*) and the first flagellomere  $0.8 \times$  as long as the second ( $1.1 \times$  in *M. splendidulus*).

***Microleptes tehriensis* Ranjith & Humala, sp. nov.**

<https://zoobank.org/A51FEE8E-3643-417D-BDED-2678E4FAD763>

Figs 9, 10

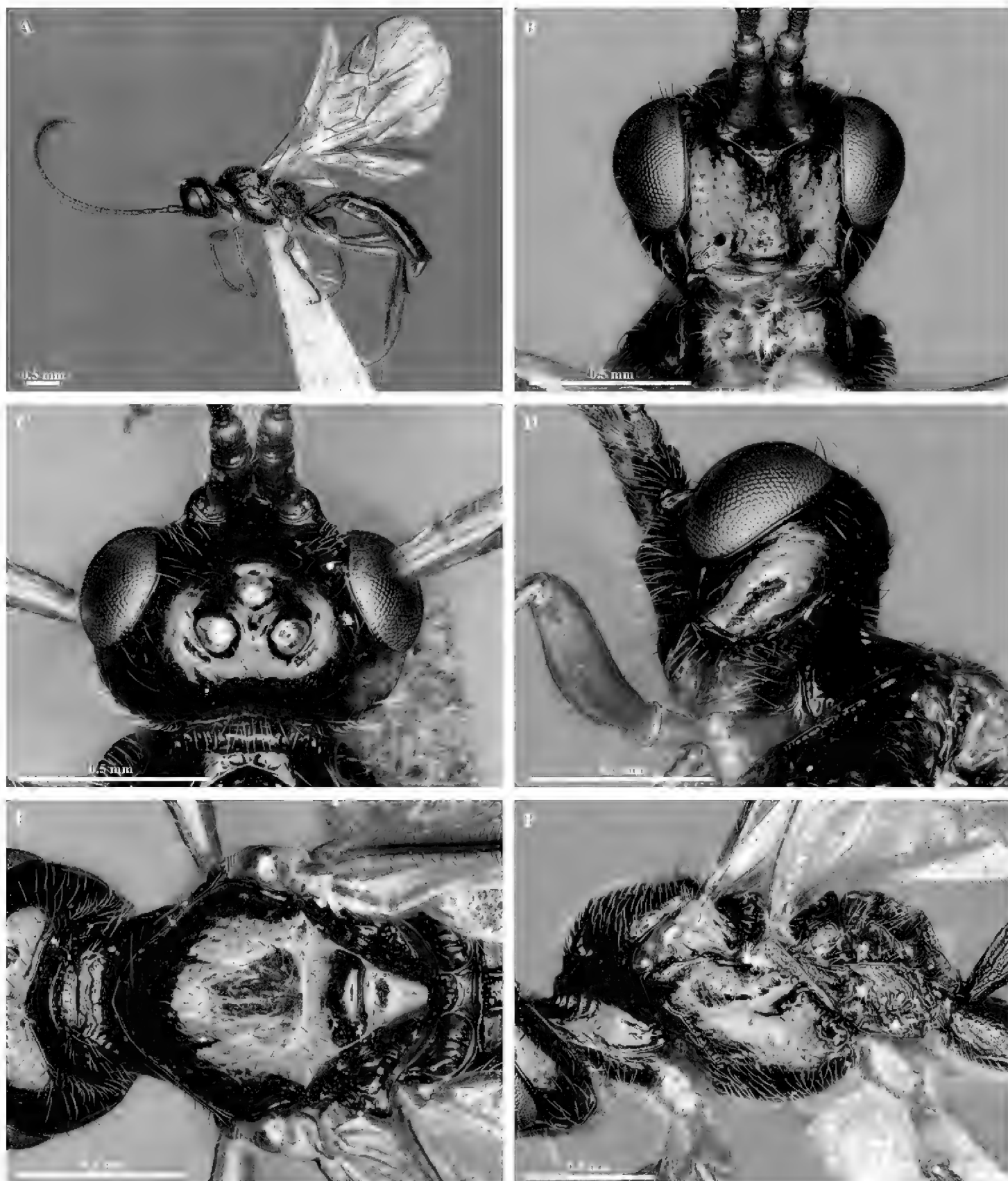
**Material examined.** *Holotype* • male INDIA: Uttarakhand, Tehri, 10.viii.2019, coll. P. Girish Kumar (ZSIK) Regd. No. ZSI/WGRC/IR/INV.27409. Paratypes, 8 males with same data as holotype (AIMB).

**Description. Holotype, male.** Body length 4.5 mm, fore wing length 3.7 mm.

**Head.** Head  $1.2 \times$  as wide as long in anterior view (Fig. 9B) and  $1.5 \times$  as wide as long in dorsal view (Fig. 9C); face flat, punctate, elevated anteriorly below antennal sockets, forming an acute protrusion, setose,  $1.8 \times$  as wide as long (Fig. 9A, B, D); clypeus transverse, smooth, with lower margin slightly convex (Fig. 9B); tentorial pits round (Fig. 9B); malar space distinctly long,  $1.7 \times$  basal width of mandible, with subocular sulcus (Fig. 9B, D); mandible broad with single broad tooth (Fig. 9B); lateral temples smooth, setose (Fig. 9D); frons and vertex smooth and sparsely setose (Fig. 9C); eye glabrous,  $1.4 \times$  as long as temple in dorsal view (Fig. 9B, C); OOL : diameter of lateral ocellus : POL =  $1.4 : 1.1 : 1.0$ ; antenna with 17 flagellomeres; all flagellomeres longer than wide (Fig. 9A); flagellomeres 1–2 with tyloids as longitudinal carinae; first flagellomere  $0.7 \times$  as long as second flagellomere,  $2.4 \times$  as long as wide; second flagellomere  $3.4 \times$  as long as wide.

**Mesosoma.** Mesosoma  $1.9 \times$  as long as high (Fig. 9F); dorsal part of pronotum crenulated medially (Fig. 9E); lateral pronotum laterally with a set of subparallel transverse ridges medially, smooth posteriorly (Fig. 9F); mesoscutum flat in lateral view, punctate, setose with a pair of elongate pits postero-laterally (Fig. 9E, F); notaulus shallow, present anteriorly (Fig. 9E); scuto-scutellar groove wide, smooth, without crenulations (Fig. 9E); scutellum smooth, sparsely setose (Fig. 9E); mesopleuron smooth, setose (Fig. 9F); mesopleural furrow widely crenulated (Fig. 9F); epicnemial carina present, joining with subtegular ridge and forming a crenulated continuous groove anteriorly (Fig. 9F); metapleuron coarsely rugose, setose (Fig. 9F); propodeum rugose;

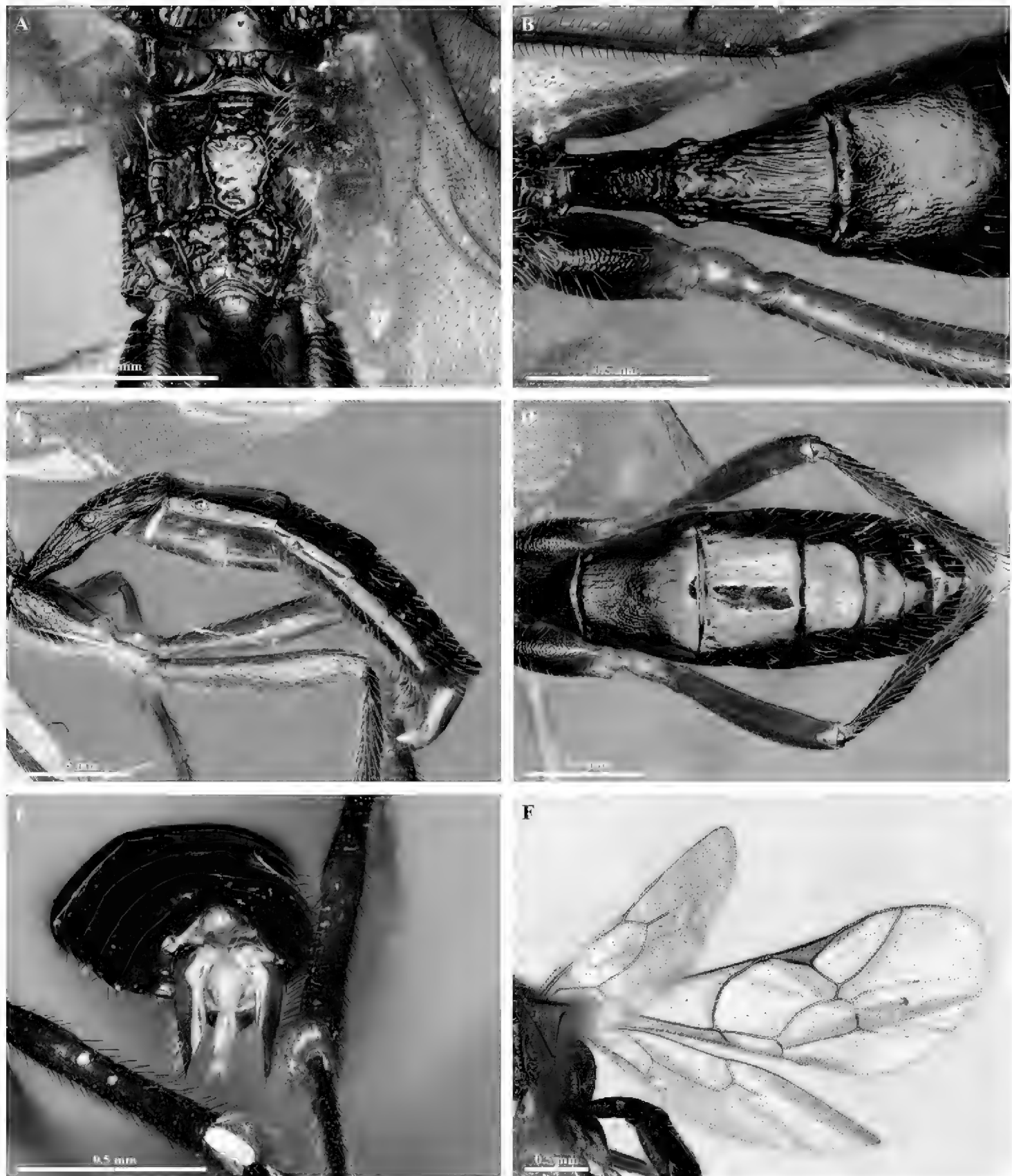




**Figure 9.** *Microleptes tehriensis* Ranjith & Humala, sp. nov., holotype, male **A** habitus, lateral view **B** head, anterior view **C** head, dorsal view **D** head, ventro-lateral view **E** mesosoma, dorsal view **F** mesosoma, lateral view.

area superomedia irregularly rugulose, narrowing basally and apically, costula indistinct; posterior transverse carina present; area dentipara longer than wide, smooth medially rest rugulose; pleural carina complete (Fig. 10A).

**Legs.** Femora slender (Fig. 9A); hind coxa rugose dorsally (Fig. 10B, C); hind femur  $5.6 \times$  as long as wide, somewhat bent upwards in profile; hind tibia  $6.5 \times$  as long as wide; hind basitarsus  $8.0 \times$  as long as wide.



**Figure 10.** *Microleptes tehriensis* Ranjith & Humala, sp. nov., holotype, male **A** propodeum, dorsal view **B** first metasomal tergite, dorsal view **C** metasoma, lateral view **D** metasoma, dorsal view **E** male genitalia **F** wings.

**Wings.** Wings hyaline (Fig. 10F); pterostigma  $3.0 \times$  as long as wide; fore wing vein  $2r\&RS$  joining to pterostigma in middle,  $2.7 \times$  as long as  $2rs-m$ ; fore wing vein  $2rs-m$  as long as  $M$  between  $2rs-m$  and  $2m-cu$ ; vein  $1cu-a$  oblique and distinctly postfurcal (Fig. 10F); hind wing with nervellus (vein  $CU$ ) intercepted below middle (Fig. 10F).

**Metasoma.** First tergite rugose in anterior half, longitudinally striate in posterior half, setose with indistinct pair of dorsal carinae,  $2.1 \times$  as long as its maximum width, spiracle situated at middle of tergite (Fig. 10B, C); second tergite with distinct

thyridium, granulate with indistinct longitudinal wrinkles anteriorly, and subpolished posteriorly, setose,  $0.9 \times$  as long as wide posteriorly (Fig. 10D); third tergite smooth, setose,  $0.7 \times$  as long as wide (Fig. 10D); tergites 4–7 smooth, setose (Fig. 10D); posterior margin of apical sternite without a median process; gonostyle almost polished, with apico-lateral patch of setae (Fig. 10C, E).

**Colour.** Body predominantly black; antenna, mandible, pterostigma, wing veins, metasoma, hind coxa, tibia and tarsus dark brown; maxillary and labial palps, tegula, fore and mid legs, hind femur and trochanters yellowish-brown.

**Female.** Unknown.

**Distribution.** India.

**Etymology.** The new species is named after the type locality, Tehri.

**Comparative diagnosis.** The new species is similar to *M. orientalis*. Apart from the differences given in the key it can be distinguished from *M. orientalis* by the following characters: antenna slenderer, with 17 flagellomeres (16 flagellomeres in *M. orientalis*) and hind femur  $5.6 \times$  as long as wide, concave dorsally ( $4.6 \times$  as long as wide and convex dorsally in *M. orientalis*).

### *Microleptes xinbinensis* Sheng & Sun, 2014

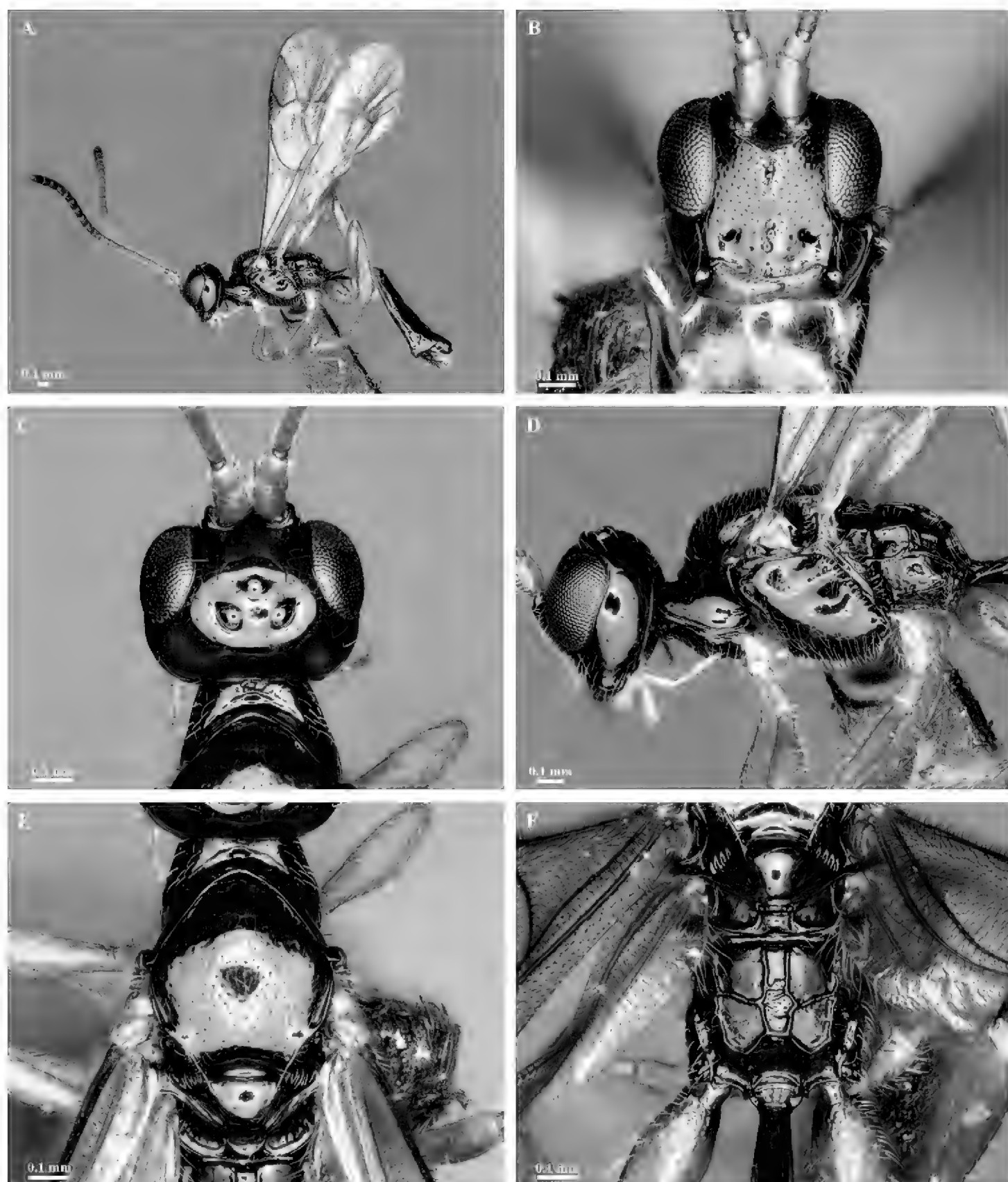
Figs 11, 12

**Material examined.** 1 female and 2 males, INDIA • Arunachal Pradesh, Yingku, Malaise trap, 17.v.2023, coll. Sahanashree, R. (AIMB).

**Description. Female.** Body length 3.5 mm, fore wing length 2.6 mm.

**Head.** Head as wide as long in anterior view (Fig. 11B) and  $1.2 \times$  as wide as long in dorsal view (Fig. 11C); face flat, punctate, setose,  $1.4 \times$  as wide as long;  $0.5 \times$  as wide as head (Fig. 11B); clypeus moderately transverse, smooth, with lower margin convex (Fig. 11B); tentorial pits transverse (Fig. 11B); malar long with distinct subocular sulcus,  $1.4 \times$  basal width of mandible (Fig. 11B); mandible broad, with single broad blunt tooth (Fig. 11B); temple polished, with sparse setae (Fig. 11D); frons and vertex smooth and sparsely setose (Fig. 11C); compound eye with short setae,  $1.2 \times$  as long as temple in dorsal view (Fig. 11B, C); OOL : diameter of lateral ocellus : POL = 1.3 : 1.0 : 1.0; antenna with 15 flagellomeres; medial flagellomeres slightly longer than wide (Fig. 11A); first flagellomere  $1.2 \times$  as long as second flagellomere,  $4.2 \times$  as long as wide; second flagellomere  $3.5 \times$  as long as wide.

**Mesosoma.** Mesosoma  $1.8 \times$  as long as high (Fig. 11D); dorsal part of pronotum crenulate medially, with medial pit (Fig. 11C, E); pronotum lateral smooth and polished (Fig. 11D); epomia absent (Fig. 11D); mesoscutum flat in lateral view (Fig. 11D), punctate, setose with a pair of elongate pits postero-laterally (Fig. 11E); notaulus short and weak, only impressed anteriorly (Fig. 11E); scuto-scutellar groove smooth, without crenulations (Fig. 11E); scutellum smooth (Fig. 11E); mesopleuron smooth (Fig. 11D); mesopleural furrow narrowly crenulated (Fig. 11D); epicnemial carina present, joining with subtegular ridge, not forming crenulated groove anteriorly (Fig. 11D); metapleuron smooth with transverse wrinkles medially, sparsely setose

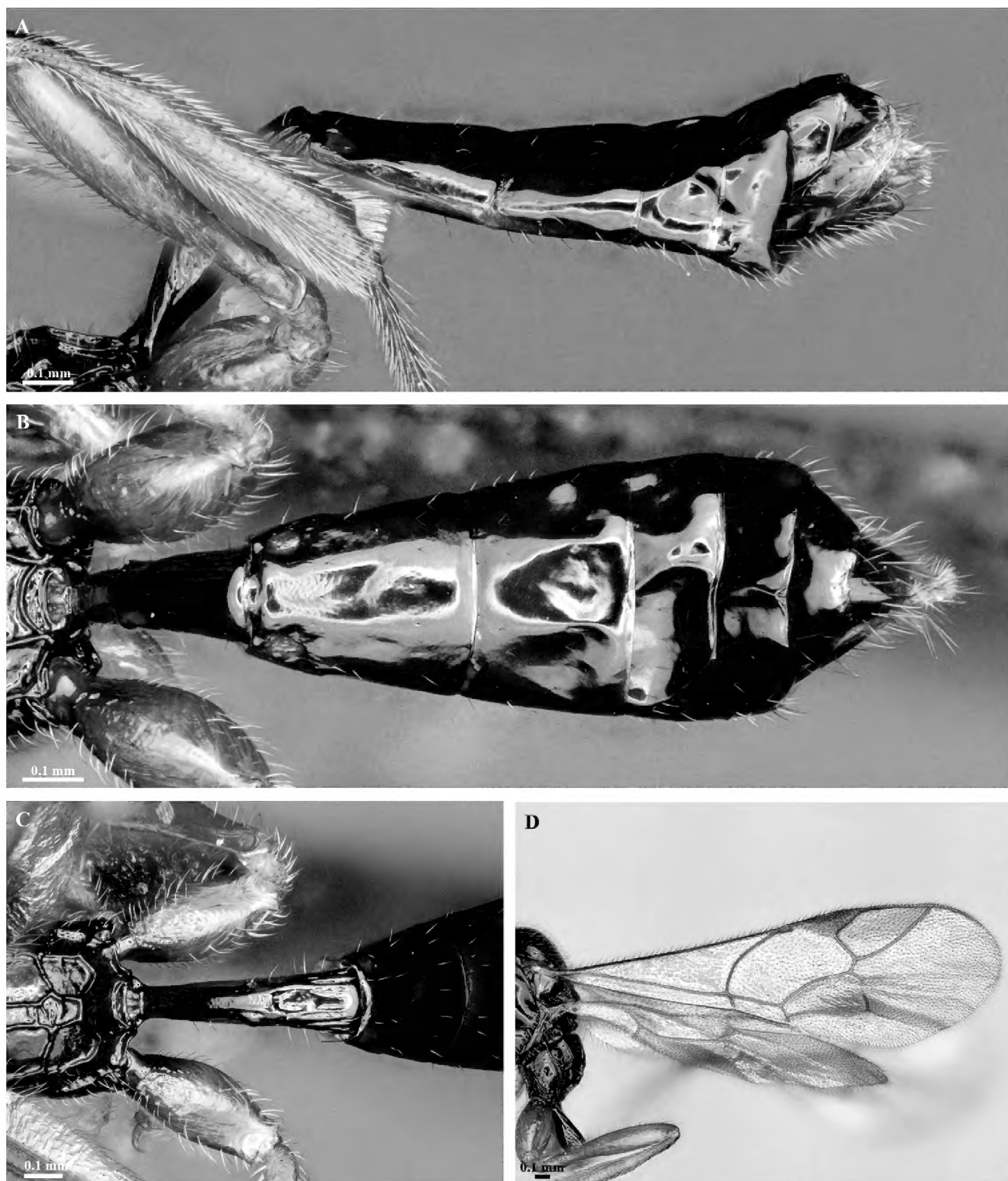


**Figure 11.** *Microleptes xinbinensis* Sheng & Sun, female **A** habitus, lateral view **B** head, anterior view **C** head, dorsal view **D** head and mesosoma, lateral view **E** mesosoma, dorsal view **F** propodeum, dorsal view.

(Fig. 11D); propodeum smooth, area superomedia nearly parallel-sided, with few transverse wrinkles medially; anterior transverse carina well developed; posterior transverse carina present; area dentipara as long as wide; pleural carina complete (Fig. 11F).

**Legs.** Femora slender (Fig. 11A); hind coxa rugose antero-dorsally (Fig. 12B, C); hind femur widened posteriorly,  $5.4 \times$  as long as wide; hind tibia  $6.0 \times$  as long as wide; hind basitarsus  $7.6 \times$  as long as wide.





**Figure 12.** *Microleptes xinbinensis* Sheng & Sun, female **A** metasoma, lateral view **B** metasoma, dorsal view **C** first metasomal tergite, dorsal view **D** wings.

**Wings.** Wings hyaline (Fig. 12D); pterostigma  $2.9 \times$  as long as wide; fore wing vein  $2r\&RS$  joining to pterostigma in middle,  $1.8 \times$  as long as  $2rs-m$ ; fore wing vein  $2rs-m$   $2.3 \times$  as long as  $M$  between  $2rs-m$  and  $2m-cu$ ; fore wing vein  $1cu-a$  distinctly postfurcal (Fig. 12D); hind wing with nervellus (vein  $CU$ ) intercepted in middle.

**Metasoma.** First tergite smooth in anterior half, irregularly longitudinally wrinkled in posterior half, with indistinct dorsal carina and sparse setae,  $3.5 \times$  as long as

its maximum width, spiracle situated at middle of tergite (Fig. 12C); second tergite with distinct thyridium, smooth, setose,  $1.1 \times$  as long as wide posteriorly (Fig. 12B); third tergite smooth, setose,  $0.6 \times$  as long as wide posteriorly (Fig. 12B); tergites 4–6 polished, scarcely setose (Fig. 12B); hypopygium straight posteriorly; ovipositor hardly exposed; sheath apically densely setose,  $0.1 \times$  as long as hind tibia (Fig. 12A).

**Colour.** Body predominantly black; scape, pedicel, flagellomeres 1–5, maxillary and labial palps, tegula, legs except hind tibia basally and hind basitarsus, thyridium yellow, flagellomeres 6–15, hind tibia basally, hind basitarsus, pterostigma, wing veins, hypopygium and ovipositor sheath brown.

**Male.** Similar to female, antennae with tyloids on flagellomeres 5–7.

**Distribution.** India and China.

**Notes.** The species was described from Liaoning province of China (East Palaearctic) and known only from a male specimen (Sheng and Sun 2014). This is the first description of the female and a first record of the species from the Oriental region.

## Discussion

Only 14 species were known in the genus *Microleptes* prior to our study, with the majority of them (12 species) distributed in the Holarctic region. One of the main reasons for the greater diversity of the genus in the Holarctic region is that it has been comparatively well studied there (Schwarz 1991; Dasch 1992; Humala 2003, 2007; Sheng and Sun 2014). The species *M. splendidulus* having the widest range has been reported from Palaearctic and Nearctic regions (Yu et al. 2016). Apart from *M. splendidulus*, only one other species, *M. rallus*, has also been reported from Nearctic region. The *Microleptes* fauna of the Oriental region has been so poorly studied that only one species, *M. malaisei*, has been recorded from Myanmar (Kasparyan 1998). The present study enriches our knowledge on the distribution of the genus to the southern part of Oriental region, with the discovering of five new species from south India and Thailand.

Based on the updated distribution range for *Microleptes*, it can be assumed that the center of species diversity of the genus *Microleptes* is confined to the East Palaearctic and Oriental regions, thus this particular area may have played a defining role in the historical process of formation of this group. Given the wide distribution of some species, such as *M. splendidulus*, the possibility of discovering more species with a wider range of distribution cannot be neglected. This applies both to the discovery of new still undescribed species, and to the possible revealing of a wider distribution of already known species. This is further supported, for example, by the new distribution record of *M. xinbinensis* from India, which was previously known only from Northeast China (Sheng and Sun 2014).

Moreover, the expansion of the area of ongoing research in the Oriental region can certainly result in the revealing of even more *Microleptes* species unknown to science, since such researches are still very rare and not systematic. In addition, the comparative rarity of these Darwin wasps in nature (most of the new species described in our study

are represented by single individuals) and, as a consequence, the scarcity of materials on *Microleptes* in collections from the Oriental region should be taken into account.

All of this point to the fact that taxonomic studies of the subfamily in the Oriental region are largely insufficient, as so far only one species from Myanmar has been described (Kasparyan 1998). Continued study of Microleptinae would be very interesting, because, in addition to discovering new species, it could possibly provide new data on the biology of *Microleptes*, which are extremely scarce. In turn, these data may provide further evidence that Microleptinae belong to the subfamily group Ichneumoniformes, as suggested by Santos (2017) and Bennett et al. (2019), or provide a rationale for rejecting this assumption. In the meantime, this research can be considered as a first attempt to reveal the higher species diversity of *Microleptes* in this area.

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